THEME: Revolutionize Aviation
LEVEL I: Vehicle Systems
LEVEL II: Propulsion and Power Level II Program

Level III: Oil Free Turbine Engine Technology

OBJECTIVE

The objective of the OFTET Project is to develop and demonstrate enabling technologies (foil bearings, tribological coatings, modeling) for high speed, high temperature Oil-Free turbomachinery propulsion systems. This project is focused on the development of foil air bearing technology. Through research, analysis and testing in support of the project's primary focus, methods of implementing foil air bearings will be developed, which will facilitate the use of these bearings in the commercial marketplace.

KEY DELIVERABLES

1	Report documenting the Preliminary Core Simulator Testing	9/04

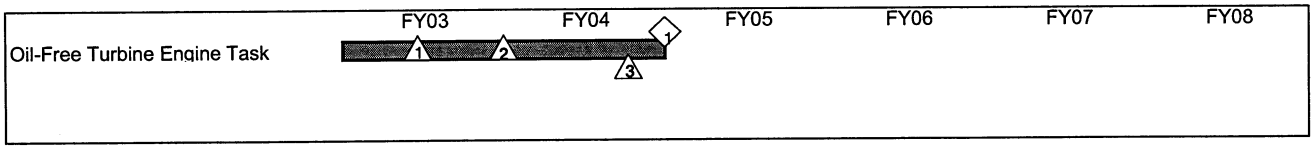
IMPACT

The project will develop, fabricate and demonstrate the use of foil bearing technology applicable to the core shaft of a proof-of-concept oil free general aviation turbofan engine. This will be accomplished through modifications to the design of the FJX-2 engine, developed under the NASA GAP Project, to make an oil-free configuration. It will require the development of upgraded shaft dynamic analysis techniques to enable accurate first principles modeling of multiple bearing turbine engine shafts incorporating radial and thrust foil bearings. Full shaft test rigs will be built to support development of the modeling codes and development/testing of oil free turbine engine shafts. Hot and cold section radial and thrust foil bearings compatible with small gas turbine engines will be developed as well as advanced coating technology. Due to funding reductions, the FY03 Level I Milestone "Complete Oil-free Core Engine Testing" will not be met, and the effort downscoped to Core Simulator Testing in FY04.

TECHNICAL APPROACH

The Oil-Free Turbine Engine Task effort is to apply recent enabling technology advances in foil bearings, solid lubricant coatings and modeling to design, fabricate, and test an oil free turbine engine. This will be accomplished through foil bearing technology scale up from the recently demonstrated turbocharger application. Foil bearing load capacity and performance characteristics required for man rated small turbine engines will be developed and evaluated in an Oil-free Rotor Simulator Test Rig. Foil thrust bearing technology will be significantly advanced for this application. This application will involve much more complex systems and dynamic issues than encountered in the previously successful oil-free turbocharger project.

SCHEDULE



MILESTONES

1	L3 - Complete Core Rotor Preliminary Design	3/03
2	**L2 - Complete oil-free FJX-2 core engine test (FY03 GPRA)**	**9/03**
3	**L2 - Complete preliminary core simulator testing**	**8/04**

MANAGEMENT

OFTET is a Level III project at the NASA Glenn Research Center. Level I Manager is Richard Wlezien at HQ. Level II Manager is Dr. Gary Seng at the NASA Glenn Research Center. Level III Manager is Robert Corrigan at the NASA Glenn Research Center. This project is in full compliance with NPG7120.5B.

RESOURCES

	FY03	FY04	FY05	FY06	FY07	FY08
Funding (M$)	1.217	1.215				
Workforce (WY)	17.0	19.0				

KEY FACILITIES

	FY03	FY04	FY05	FY06	FY07	FY08
Test Rigs						
Ambient Pressure Bearing Test Rig						
Oil-free Rotor Simulator Test Rig						

AGREEMENTS

Partner	Agreement Title	Number
Mohawk Innovative Technology, Inc.	Rotor Bearings for Oil-Free General Aviation Engine	NAS3-02066
Williams International	RASER Task Order: Rotor Bearing Integration for Oil-Free General Aviation Engine	NAS3-01127

ACQUISITION STRATEGY

Due to the broad nature of the Oil Free Turbine Technology project, a variety of acquisition instruments will be employed. Procurements will be in accordance with approved procedures at the procuring GRC. Free and open competitive procurements will be used to the maximum extent possible. Among the approaches to procurement, the most likely include NASA Research Announcements (NRA), NASA Cooperative Agreement Notices (CAN), and Requests for Proposal (RFP). These vehicles will result in grants, cooperative agreements and contracts. For any onsite contractors, performance based contracts are the preferred instrument. Two major procurements will be through a Phase III SBIR contract with Mohawk Innovative Technology, Inc. for development and fabrication of the foil bearings, and use of the Revolutionary Aeropropulsion System Engineering Research (RASER) contract for tasks with Williams International for FJX-2 engine redesign, modifications and sea level testing.

RISK MANAGEMENT

Risk	Mitigation Strategy
Shortfall in technical staff; project is unable to develop full technology base needed to complete project, resulting in cost/schedule overruns, lower quality/quantity of work, long-term program (large engine) goals won't be met.	1. Training for current staff to add/enhance skill base 2. Advocate need for staffing and program status with program office 3. De-scope efforts
Given that key PI's (H.H., CDC) could be unavailable; then planned/expected technology developments may not occur.	Regular technical reviews and contact with contractors
Given that true project costs were underestimated; then project may run out of funding	Close monitoring of costs and technical results with focus on reallocation or de-scope if necessary
Lack of performance of oil-free technology due to unexpected engine conditions, bearing capacity limits, test rig failures, limited coating capability.	Regular technical reviews with contractors and feedback to project manager
Trusting relationships between government personnel and contractors could be disrupted with a lack of free flow of information hampering communications if sensitive information the project holds were leaked	Ensure proprietary markings on documents and proper handling

TECHNOLOGY TRANSFER

An objective of the Oil Free Turbine Engine Technology Project is to ensure rapid and effective dissemination of the technology to the U.S. industry. Technology transfer mechanisms depend on the maturity of the technology. A variety of technology transfer mechanisms will be employed. The most important mechanisms are direct involvement by the customers in the formulation of the project described in this plan, direct contract of R&D and cooperative agreements with industry and other government agencies. The Oil Free Turbine Engine Technology Project funds R&D contracts and grants that ensure direct transfer of technology to the U.S. industry, increasing the likelihood of transfer into customer products. Technology exchange also occurs among the participants through special technical working group meetings. Presentations at technical conferences and other similar professional societies will be limited to discussion of non-competitively sensitive information. Other methods of technology transfer include publication of NASA technical reports, communications between NASA, industry and other government agencies through MOA's, and technical demonstrations at NASA and user facilities.

EDUCATION OUTREACH

The Oil Free Turbine Engine Technology Project will work closely with the Level II Office to further communicate technology to a wide range of potential users outside the traditional aerospace community. This includes such fields as medical, ground transportation, and communications. It also includes educational opportunities including kindergarten to grade 12.

SIGNATURES

Gary Seng 9/26/02
Gary Seng
Level II Manager

Robert Corrigan 9/26/02
Robert Corrigan
Level III Manager